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Food-Stressed Great Horned Owl Kills Adult Goshawk: Exceptional Observation or Community Process?

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Great Horned Owls (*Bubo virginianus*) can prey on other owl and diurnal raptor species up to the size of Northern Goshawks (*Accipiter gentilis*), and the question has been raised why this behavior occurs and whether it affects the structure of raptor communities (Craighead and Craighead 1956, Mikkola 1983, Voous 1988). Most reports originate from analyses of pellets of prey remains collected at owl nests and roost sites. There is little specific information on how the owls kill potential harmful prey, nor about the ecological conditions that facilitate such predation. During our study of avian predation in the boreal forest ecosystem near Kluane Lake in the southwestern Yukon (Krebs et al. 1992), we encountered circumstantial evidence for an owl predation of an adult female goshawk, which led us to a revised assessment of such interspecific killings among raptors.

On 18 June 1991, we found a goshawk nest on the flat top of a dead White Spruce (*Picea glauca*) about 10 m high. The nest was unusually exposed above canopy height of the surrounding trees (all other 28 goshawk nests found in our study areas were 4–8 m below canopy height). Fresh streaks of whitewash and two plucking sites with fresh prey remains indicated that the nest was active, and we were attacked by both parents. Because we heard loud begging calls, but the chicks were not yet visible at the nest edge, we estimated their ages to be 2–3 wk.

On 25 June 1991, the nest area was quiet and there were no fresh whitewash or new prey remains. We found numerous breast feathers and the left wing of an adult goshawk 2 m from the base of the nest tree, together with four Great Horned Owl feathers. More goshawk feathers, including a goshawk's right wing, were found under a 1 m high log perch about 12 m from the nest tree. The wings measured 356 mm, indicating they were from a female goshawk (Mueller and Berger 1968). Because the goshawk remains were several days old on 25 June, we estimated that the predation occurred between 18 and 22 June.

During the same period, we monitored a Great Horned Owl family with a nest 1.0 km from the goshawk nest. The two owl fledglings were tethered to an elevated artificial platform for diet study (Petersen and Keir 1987). We moved two additional young Great Horned Owls to the platform for a brood size manipulation experiment from 10–20 June. The adult female owl was equipped with a backpack radiotransmitter, and we recorded her locations once every second night. Food stress during the brood addition experiment was suggested by a decrease in the amount of food brought to the platform, declining owlet weights, and increased hunting distances from its nest by the female owl. The goshawk nest was within the territory of the owl pair, but the telemetry locations did not reveal any relation to the goshawk nest. On 27 June, we found the remains of the right leg of an adult female goshawk beside the owl tethering platform. The remains were several days old, and presumably were dropped by the owls

Discussion

Why Publish a Single Observation? Because of the nature of rare events, a sufficient sample size for testing hypotheses can only be achieved as a collaborative effort of different researchers who publish few or even single observations on this topic (Schmutz 1992). The fact that Great Horned Owls kill other birds of prey has been well documented (reviews in Craighead and Craighead 1956, Mikkola 1983, Voous 1988), and no further publications are needed to simply report this behavior. We agree with Bortolotti (1992) that the publication of single observations should allow links to the analysis or interpretation in a higher-level context. As a consequence, we suggest not publishing short notes that simply report the interspecific killing among raptors—instead we should ask the question when and why it occurs, and focus on the context of these observations. In our case, we present a single observation with additional information that shows potential links to causes and implications of this behavior: we will 1) try to estimate how rare such events were during our study, and 2) discuss how the documented details of the ecological context of both predator and prey relate to hypotheses on the evolution of interspecific killing among raptors.

How Frequently do Great Horned Owls Kill Other Birds of Prey? We monitored 17 goshawk nests during 1989–91 and found a maximum of two possible cases of Great Horned Owl predation on goshawks. The second case was a brood that disappeared for unknown reasons. The described goshawk nest was exposed above canopy height, which is an unusual situation in our study area and elsewhere (Shuster 1980, Hall 1984). Owl predation may rather affect the nest site selection than the population dynamics and density of other raptors. Predation by Great Horned Owls, however, has been reported to account for higher mortalities in other species: up to 30% of juvenile Spotted Owls (*Strix occidentalis*; Forsman et al. 1984, Gutierrez et al. 1985, Miller and Meslow 1986), 65% of juvenile Great Gray Owls (*S. nebulosa*; Duncan 1987), 0–

44% of young Red-tailed Hawks (*Buteo jamaicensis*; McInvaille and Keith 1974, Houston 1975), up to 27% (Walton and Thelander 1988) or locally even more (Steidl et al. 1991a) of fledged or released Peregrine Falcons (*Falco peregrinus*), up to 21% of hatched Ospreys (*Pandion haliaetus*; Steidl et al. 1991b), 25 predations on young Harris' Hawks from 64 nests (*Parabuteo unicinctus*; Dawson and Mannan 1991). It is possible that the literature is biased toward high predation, because surprising results may be more likely to be published. We encourage also the reporting of low predation rates in areas where the populations of several raptor species are known.

Killing Other Birds of Prey: a Response to Food Stress? We found it interesting that the goshawk was killed by an owl under food stress, which we had induced experimentally. During our study, the overall prey base was high because Snowshoe Hares (*Lepus americanus*) were at the peak of their population cycle (Krebs et al. 1992), and the overall predation by owls on goshawks was low. It is intriguing to hypothesize that top-predators kill lower-level predators more often when other prey is scarce. In support of this hypothesis, McInvaille and Keith (1974) found a lower predation rate by Great Horned Owls on Red-tailed Hawks when Snowshoe Hares were at peak densities. More predation rates on raptors should be reported in conjunction with estimates of other prey species.

Raptors Killing Raptors: Predation or Competition? Observations of raptors killing raptors have been considered anomalies. As a consequence many short notes and specific lists in handbooks have been published (review in Voous 1988). This perspective is based on the assumption that raptors are a costly prey because of the high risk of injury to an attacking predator. Why raptors kill other raptors despite the high costs involved, has been explained by the additional benefits of removing a potential competitor (review in Mikkola 1983). Benefits other than reduced competition for food may be reduced competition for nest sites, increased protection of young from predation, and increased protection from harassment (Klem et al. 1985).

When raptors kill other raptors, do they really suffer a higher risk of injury? We are not aware of analyses of risks involved in capturing different prey. Our case of an owl possibly attacking a brooding or sleeping goshawk suggests that there may be no more risk involved than when attacking any other prey. The most parsimonious explanation is that raptors kill raptors simply to obtain food, or in other words, to obtain direct and immediate benefits. At the present state of our knowledge, we should take this simple explanation as a null-hypothesis, and our scientific effort should be directed toward testing it. We can reject this null-hypothesis only if field data do not meet the predictions derived from it. For example, the null-hypothesis predicts that killed raptors are as likely to be consumed as any other prey, or that the proportion of raptors in the diet should reflect their availability as much as any other prey.

CONCLUSIONS

A Great Horned Owl killing an adult goshawk was a rare event with little impact on the goshawk population during our study. The frequency of such predation may vary with prey abundance, however, and may be more pronounced when other prey is scarce. Based on the detailed knowledge of the ecological situation of our case, we question the current perspective that raptors killing raptors are anomalies that involve a high risk and require competition as an explanation. More observations in a known context are needed to test hypotheses on why this phenomenon occurs.

RESUMEN.—Hemos estudiado los nidos del Gavilán Azor (*Accipiter gentilis*) y del Tecolote Cornudo (*Bubo virginianus*) que estuvieron ubicados a 1 km de distancia el uno del otro. Los residuos encontrados en ambos nidos son evidencia de que uno de los búhos de la especie *B. virginianus* mató a un *A. gentilis* hembra cerca de su nido. Los búhos estuvieron sometidos a escasez de comida, la que fue inducida por nosotros al aumentar el número de pollos en el nido. El nido del *A. gentilis* estuvo extremadamente expuesto. Durante nuestro estudio, esta depredación fue un evento raro, con poco impacto en la población de *A. gentilis*. La frecuencia de tales depredaciones puede ser más numerosa cuando la presa es escasa. Basados en el conocimiento detallado de la situación ecológica de nuestro estudio, nosotros dudamos de la creencia de que la muerte de una ave raptora causada por otra, es una anomalía que lleva un gran riesgo, y que sólo se explica por la competencia entre raptoras.

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NESTING ASSOCIATION BETWEEN THE WOODPIGEON (*Columba palumbus*) AND THE HOBBY (*Falco subbuteo*)

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Nest predation is the main cause of breeding failure in birds (Ricklefs 1969). Various mechanisms for defending nests against predators have evolved. In their classification of nest defenses, Collias and Collias (1984) recognized, among others, species which use "protective nesting association with formidable species"; the formidable species can be large birds of prey, wasps, bees or termites and their nests, or humans and their habitations. It is presumed